Distribution and Status of Selected Fishes in North Carolina, With a New State Record

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ABSTRACT - We made status surveys of 22 state-listed fishes in the French Broad River, Nolichucky River, and Dan River systems from 1991-1995 from 105 collections at 99 sites made by us, augmented by data from 146 collections made by others, personal communications, and the literature. We believe state-listed endangered *Polyodon spathula* and *Percina sciera* have been extirpated from the state whereas *Exoglossum maxillingua*, *Thoburnia hamiltoni*, *Noturus flavus*, *N. gilberti*, and *Percina burtoni* are either secure or rare. All six threatened species surveyed were collected. Of these, *Lampetra appendix*, *Cyprinella monacha*, *Cottus carolinae*, and *Aplodinotus grunniens* probably warrant being elevated to state-endangered status, whereas *Luxilus chrysocephalus* and *Percina caprodes* appear to be secure. Nine species of special concern were surveyed. *Noturus eleutherus* and *Etheostoma simoterum* are presumed to be extirpated from the state and *Acipenser fulvescens*, *Hiodon tergisus*, and *Carpiodes carpio*, if not extirpated, probably do not now have reproducing populations in North Carolina. *Etheostoma vulneratum* is restricted to the Little Tennessee River system and *Percina squamata* occurs in low numbers in the French Broad, Hiawassee, Little Tennessee, and Nolichucky river systems. Both warrant consideration for elevation to threatened status.

Scartomyzon ariommus and *Etheostoma podostemone* have apparent healthy populations in the Dan River system. The first record of *Ichthyomyzon bdellium* from North Carolina is presented.

The North Carolina Wildlife Resources Commission lists 9 species of fishes in this state as endangered, 11 as threatened, and 30 as of special concern (Article 25, Chapter 113 of General Statutes of the State of North Carolina, 1987, amended 1991). Since 1988 we have surveyed some of these species, and to date have reported on the distribution and status of the sandhills chub, *Semotilus lumbee*, and the pinewoods darter, *Etheostoma mariae* (Rohde and Arndt 1991), and of the sharphead darter, *E. acuticeps* (Rohde and Arndt 1994). In this paper we add new, and summarize existing, data on the distribution and status of 22 of the 25 state-listed fishes that occur in the North Carolina portions of the French Broad and Nolichucky river systems (Tennessee River drainage) and in the Dan River system (Roanoke River drainage). The former are located in the Blue Ridge Physiographic Province and the Dan River headwaters are located in Appalachian Mountain remnants in north central North Carolina in the Piedmont Physiographic Province. We also provide records on a species of fish new to North Carolina.

Three endangered, five threatened, and nine of special concern fish species (34% of the state total) occur in the French Broad River system; two endangered, two threatened, and one species of special concern (10% of the total) occur in the Nolichucky River system; and three endangered and two of special concern fishes (10% of the total) occur in the Dan River system (Table 1).

SURVEY AREAS

The French Broad River originates in North Carolina and runs some 166 river kilometers (rkm) to where it enters Tennessee and drains approximately 4,163 km^2 of North Carolina (Fig. 1). River elevation over this reach (Fig. 2) drops from 640 m to 378 m; river gradient from its headwaters to Asheville is 2.6 m/km and from Asheville to the Tennessee border is 5.2 m/km (Richardson et al. 1963). Redmon Dam near Marshall in Madison County, North Carolina, prevents upstream movement of fishes, and six species that might be expected to occur farther upstream are known only from below the dam (Menhinick 1986).

The Nolichucky River and its three major tributaries (Fig. 2), the Cane, North Toe, and South Toe rivers, drain an area of about 1,666 km^2 (Crowell 1965). The Nolichucky River enters Tennessee at an elevation of 539 m (Crowell 1965), and joins the French Broad River at Douglas Reservoir in Jefferson County, Tennessee (Fig. 1).

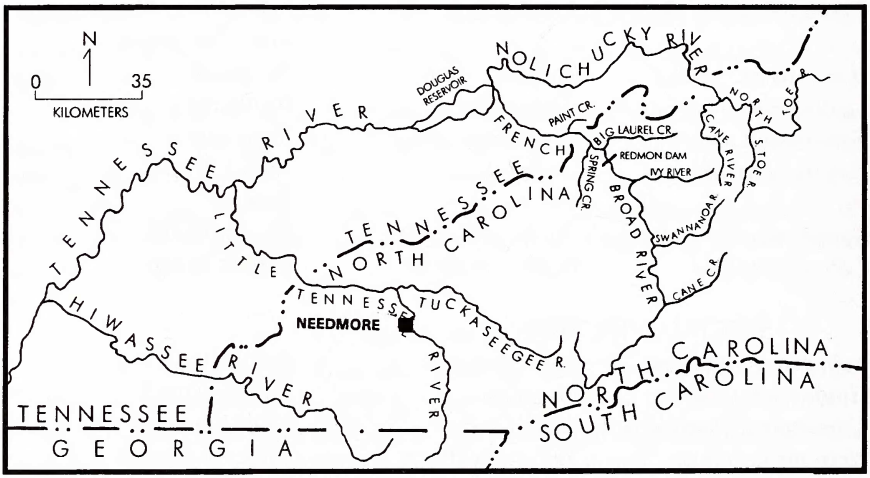
Table 1. List (1991) of endangered, threatened, and special concern fishes found in the mountainous portions of North Carolina (from Article 25, Chapter 113 of General Statutes of the State of North Carolina, 1991).

Scientific Name	Common Name	River System Occurrence
ENDANGERED		
Polyodon spathula	Paddlefish	French Broad
Exoglossum maxillingua	Cutlips minnow	Dan
Scartomyzon hamiltoni	Rustyside sucker	Dan
Noturus flavus	Stonecat	Nolichucky
Noturus gilberti	Orangefin madtom	Dan
Percina burtoni	Blotchside logperch	French Broad Nolichucky
Percina sciera	Dusky darter	French Broad
THREATENED		
Lampetra appendix	Amer. brook lamprey	French Broad
Cyprinella monacha	Spotfin chub	French Broad Little Tennessee
Hybopsis rubrifrons	Rosyface chub	Savannah
Luxilus chrysocephalus	Striped shiner	Nolichucky
Etheostoma acuticeps	Sharphead darter	Nolichucky
Percina caprodes	Logperch	French Broad New
Aplodinotus grunniens	Freshwater drum	French Broad
Cottus carolinae	Banded sculpin	French Broad
SPECIAL CONCERN		
Acipenser fulvescens	Lake sturgeon	French Broad
Hiodon tergisus	Mooneye	French Broad
Clinostomus funduloides	Rosyside dace	Little Tennessee
Notropis lutipinnis	Yellowfin shiner	Little Tennessee Savannah
Phenacobius teretulus	Kanawha minnow	New
Carpiodes carpio	River carpsucker	French Broad
Scartomyzon ariommus	Bigeye jumprock	Dan
Noturus eleutherus	Mountain madtom	French Broad
Etheostoma inscriptum	Turquoise darter	Savannah
Etheostoma jessiae	Blueside darter	French Broad
Etheostoma podostemone	Riverweed darter	Dan
Etheostoma simoterum	Snubnose darter	French Broad

Table 1. Continued.

Etheostoma vulneratum	Wounded darter	French Broad
		Little Tennessee
Percina macrocephala	Longhead darter	French Broad
Percina oxyrhyncha	Sharpnose darter	New
Percina squamata	Olive darter	French Broad
		Hiwassee
		Little Tennessee
		Nolichucky

Fig. 1. Upper Tennessee River drainage, North Carolina and Tennessee.



The Dan River is the major southern tributary to the Roanoke River. It originates on the Blue Ridge uplands in south central Virginia and, after a course of 59 rkm, enters North Carolina in northwest Stokes County; it crosses the state line five more times before joining the Roanoke River at Kerr Reservoir in Halifax County, Virginia (Fig. 3). The 140 rkm North Carolina portion drains approximately 4,410 km^2 of the state. River elevation drops from 366 m at the point where it first enters North Carolina to 140 m where it first exits North Carolina in northeast Rockingham County (from U.S. Geological Survey 7.5 minute series topographic maps).

Fig. 2. French Broad and Nolichucky river systems, North Carolina.

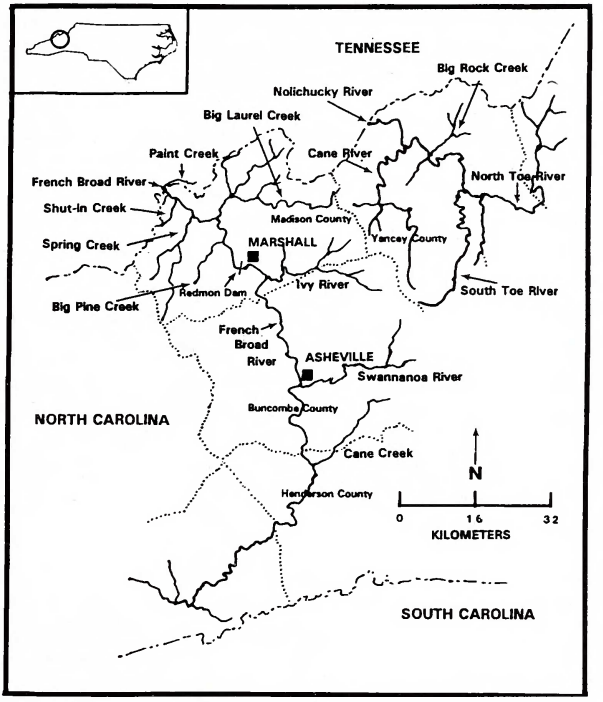
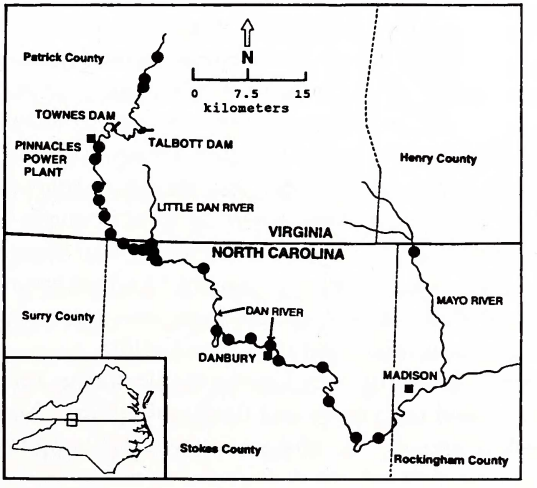
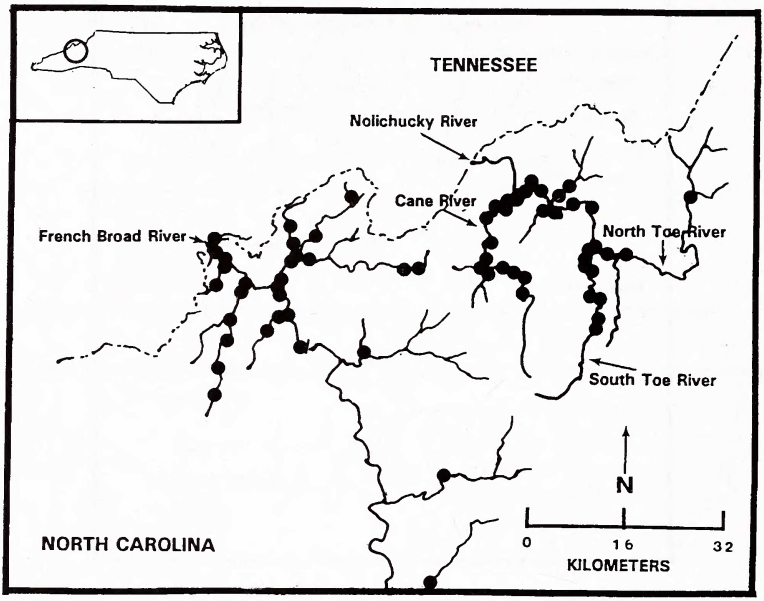


Fig. 3. Dan River system with sites (dots) we sampled from July 1992 to May 1995. Some dots overlap.



All three rivers are generally bordered by forest, although some land is pasture. River substrate ranges from bedrock to boulders to cobble to silt.

Fig. 4. French Broad and Nolichucky river systems with sites (dots) we sampled from July 1991 to April 1995. Some dots overlap.



METHODS AND MATERIALS

We sampled 99 sites in 105 collections: 32 sites in the lower reach of the French Broad River and some of its tributaries from May 1994 to May 1995, and at 2 sites in the middle reach of the river in September 1993 (Fig. 4); 39 sites in the Nolichucky River system between July 1991 and November 1994 (Fig. 4); and 15 sites in the Dan River and in 2 of its tributaries 25 times from July 1992 to May 1995 (Fig. 3). We sampled most sites only once, although four sites each in the French Broad and Nolichucky rivers were each sampled twice. We also sampled 11 sites in the Virginia portion of the upper Dan River from November 1993 to October 1994 (Fig. 3). All site locations and dates are available from the senior author. In addition, we include data from 146 collections made by others, other personal communications, and from the literature.

We sampled primarily with a backpack electroshocker and seine, using the technique described by Jenkins and Burkhead (1975). Each site was electrofished for 45-190 minutes, i.e., until we believed that sampling had been com-

prehensive. However, in the French Broad and in the Nolichucky rivers, we sampled 12 sites in 1991 and 2 in 1994 only by seine (3.05 m x 1.2 m, 0.64 cm mesh), and we sampled 2 sites in the former river in 1994 only by a 25 m, 14 cm stretched mesh monofilament gill net and a 50 m, 5.1 cm stretched mesh monofilament gill net. The nets were deployed overnight and fished on consecutive days for a total of six net days. In the Dan River in 1992 and in 1994, we sampled two sites in each year only by seine (size as above). At five sites in the North and South Toe rivers, in addition to sampling with electroshocker and seine, we also surveyed fishes underwater by snorkeling. In all sampling efforts, the known preferred habitat for each species was sampled most intensively.

In addition to the fishes taken, data on stream depth, width, and substrate type; current; air and water temperatures; pH; and dissolved oxygen concentration were often recorded at a site, and we include these data when available. Fishes were preserved in 10% formalin upon capture for subsequent examination. Fish measurements when available are given; TL is total length and SL is standard length. We deposited preserved specimens in the North Carolina State Museum of Natural Sciences in Raleigh. Scientific and common names of fishes used herein follow Mayden et al. (1992), except for *Cyprinella monacha* which follows Jenkins and Burkhead (1994).

We include figures that show all of our known fish capture localities in North Carolina. In our species accounts we occasionally include records of fishes taken in portions of adjacent states in an effort to make the accounts more accurate and complete.

Positive results are gratifying, but, as usual, negative results are not necessarily conclusive. When fish populations in rivers and large creeks decrease strongly, it becomes virtually impossible to differentiate between occurrence at a low level and extirpation (Etnier 1994).

RESULTS AND DISCUSSION

TENNESSEE RIVER DRAINAGE

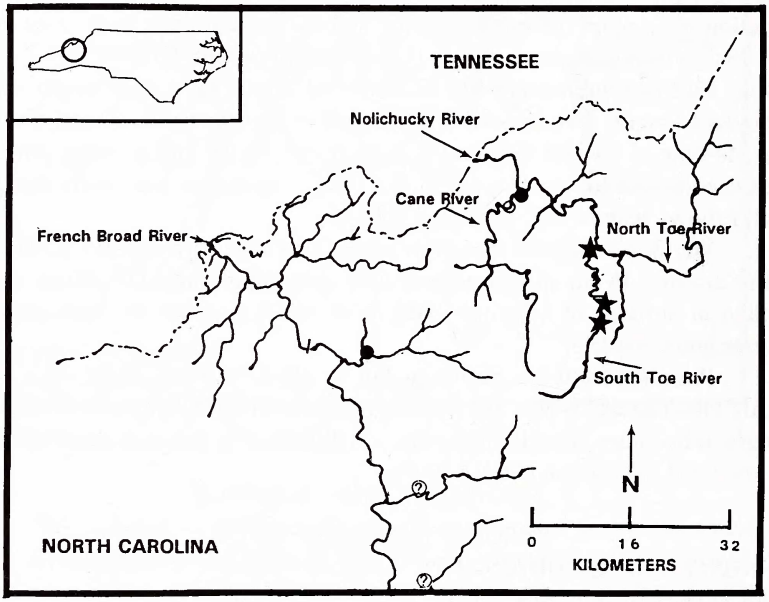
ENDANGERED SPECIES

Paddlefish, *Polyodon spathula* (Walbaum)

The paddlefish once occurred throughout the Mississippi River and its larger tributaries, but its distribution has decreased coincidental with river channelization, damming, and overfishing (Burr 1980). Cope (1870) maintained that it migrated up the French Broad River as far as Asheville in Buncombe County, North Carolina. Fishermen in this state reported that it had been caught in the lower reaches of the French Broad River as recently as 1983, but none of these reports has been substantiated by specimens (E. Menhinick, personal communication, 1994). We sampled with large-mesh gill nets in the French Broad River downriver of Hot Springs and in the river at the mouth of Big Laurel Creek, both Madison County, North Carolina, on 14 and 15 May and 15 and 16 August, 1994,

respectively. Swift currents limited our efficiency. We caught no paddlefish. Local fishermen in Madison County whom we questioned in 1994 told us that they had never seen a paddlefish from North Carolina nor heard of one caught there. We presume that the paddlefish has been extirpated from North Carolina.

Fig. 5. Distribution of the stonecat, *Noturus flavus*, (circle) and the blotchside logperch, *Percina burtoni*, (star) in the French Broad and Nolichucky river systems, North Carolina. An open circle overlaps two historical sites where the stonecat was not taken in this survey. Specific historical sites for the blotchside logperch in Cane Creek and the Swannanoa River are not known and are plotted as circles with a question mark.



Stonecat, *Noturus flavus* Rafinesque

The stonecat is distributed through portions of the Mississippi River basin, the Great Lakes, the Ohio River basin, and the St. Lawrence, Mohawk, and Hudson River systems (Rohde 1980). In North Carolina it is documented from only three sites in the Cane River, where it was collected on 18 June (one specimen) and 26 June (six), 1984, and 15 September 1985 (two) (Menhinick 1986). Despite our efforts to collect it at all three sites, we took two adults (photographed and released) only at the downstream-most site on 4 September 1993 (Fig. 5).

We record it here for the first time from the Ivy River, a tributary to the French Broad River, from upstream of Marshall in Madison County, North Carolina, where we took three adults (90-99 mm SL) on 14 August 1994 (Fig. 5). One adult (86 mm TL) and one specimen (released, not measured) were collected in the Little Tennessee River at Needmore in Swain County, North Carolina, by Tennessee Valley Authority (TVA) personnel on 20 June 1994 (E. Scott, personal communication, 1994) (Fig. 1). This site had been sampled five times by TVA biologists during the period 1988-1993 and once by us in 1993. The discovery of the species there in 1994 was unexpected. Preferred habitat was gravel riffles. Current at the Ivy River site was 0.31 m/sec, water temperature 20.6 C, pH 8.0, and dissolved oxygen concentration 8.0 ppm. Its status of endangered in North Carolina is warranted.

Blotchside logperch, *Percina burtoni* Fowler

The blotchside logperch occurs in disjunct populations in the Tennessee River drainage from westcentral Tennessee to southwestern Virginia (Page and Burr 1991); where it occurs it is localized and rare (Etnier 1994). In North Carolina it was taken at one site in Cane Creek (Henderson County) in 1902, at one site in the Swannanoa River (Buncombe County) in 1934, and at two sites in the South Toe River (Yancey County) in 1975 and 1977 (Menhinick 1986) (Fig. 5). We collected two adults (120 mm SL, one released) at a new locality in the South Toe River near its confluence with the North Toe River in September 1993. Since we noted that this fish can readily avoid electroshockers and seines, we observed 2 to 6 adults in each of 4 visits by snorkeling at the two upstream historic sites in the South Toe River in July and September 1993 and August 1995 (Fig. 5). Preferred habitat was in pools below riffles. Menhinick (1986) presumed *P. burtoni* to have been extirpated from the Swannanoa River and from Cane Creek since he did not obtain it there in 14 collections nor did the North Carolina Division of Environmental Management in 5 collecions (V. Schneider, personal communication, 1994). We did not collect it in either stream in two collections made there in 1993, and we concur with Menhinick (1986). Its continued presence in North Carolina is tenuous.

Dusky darter, *Percina sciera* (Swain)

The dusky darter occurs from the Wabash River drainage in Indiana south and west to the Guadalupe River drainage in Texas and east to the Tombigbee-Black Warrior river system in Alabama (Page 1980). In North Carolina it is known only from Spring Creek, Madison County, where U.S. Forest Service personnel collected one specimen in 1966 and one in 1969 (Auburn University Collection 3442), although the specific sites are now not known (M. Seehorn, personal communication, 1994). We made 13 collections at 7 sites with suitable habitat in Spring Creek over a distance of 27.3 rkm in 1994 and 1995. We did not collect it. Apparently never widespread or common in North Carolina, we

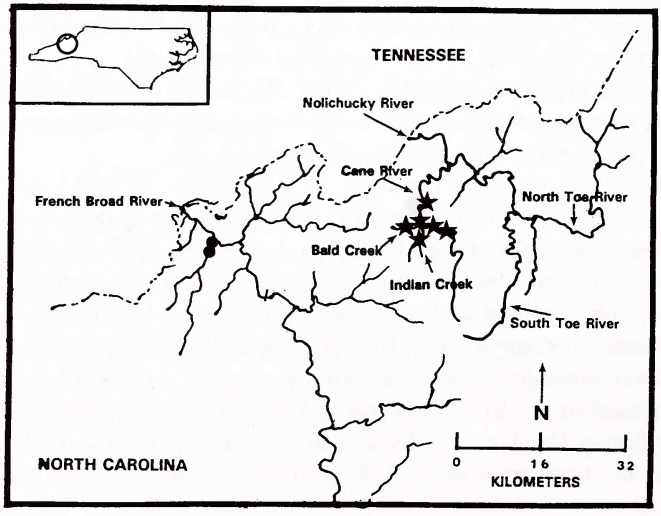
consider the dusky darter to have been extirpated from this state by unknown causes. It appears to be a relatively tolerant species in other portions of its range.

THREATENED SPECIES

American brook lamprey, *Lampetra appendix* (DeKay)

The American brook lamprey is widely distributed in the St. Lawrence and Mississippi river basins from New York to northern Arkansas, and on Atlantic Slope drainages from southern Quebec south to the Roanoke River drainage in Virginia (Page and Burr 1991). In North Carolina it was known from only one site in the downstream reach of Spring Creek, Madison County, at a point where a railroad trestle crosses this creek, where 26 individuals were taken in 1980 and 1 in 1983 (Menhinick 1986). We took one adult some 200 m downstream of the above site (and about 50 m upstream of the confluence of Spring Creek with the French Broad River, Madison County) on 22 April 1995 (Fig. 6), and two adults on the same day, also in Spring Creek at a point about 0.9 rkm above this confluence. They were males and measured 144, 147, and 157 mm TL. All were taken in gravel riffles where the current was 0.45 m/sec. We collected one ammocoetes of 152 mm TL in a sandy-bottomed pool about 50 m downstream of the last-mentioned Spring Creek site on 14 August 1994. The pH here was 6.9, and the dissolved oxygen concentration was 8.4 ppm. This species appears to be restricted to this creek in North Carolina. Its status of threatened in North Carolina appears to be conservative.

Fig. 6. Distribution of the American brook lamprey, *Lampetra appendix*, (circle) and the striped shiner, *Luxilus chrysocephalus*, (star) in the French Broad and Nolichucky river systems, North Carolina. Some symbols overlap sites.



Spotfin chub, *Cyprinella monacha* (Cope)

The spotfin chub is endemic to the Tennessee River drainage in disjunct populations from southwestern Virginia to northwestern Alabama and in the Buffalo River in central Tennessee (Jenkins and Burkhead 1984, Etnier and Starnes 1994). It has apparently been extirpated from Alabama and Georgia (Etnier and Starnes 1994). In North Carolina it is restricted to a 16.8 rkm section of the Little Tennessee River in Macon and Swain counties (Alderman 1987). We collected and released 27 spotfin chub in this river at Needmore in Swain County (Fig. 1) on 25 September 1993. Three previous North Carolina records, two from the French Broad River system (1888) and one from the Tuckaseegee River (1940), apparently represent now extirpated populations (Menhinick 1986). We did not take it in 36 collections in the French Broad River system, and we concur with Menhinick (1986) that it has been extirpated from this drainage. Its status of threatened in North Carolina appears to be conservative.

Striped shiner, *Luxilus chrysocephalus* Rafinesque

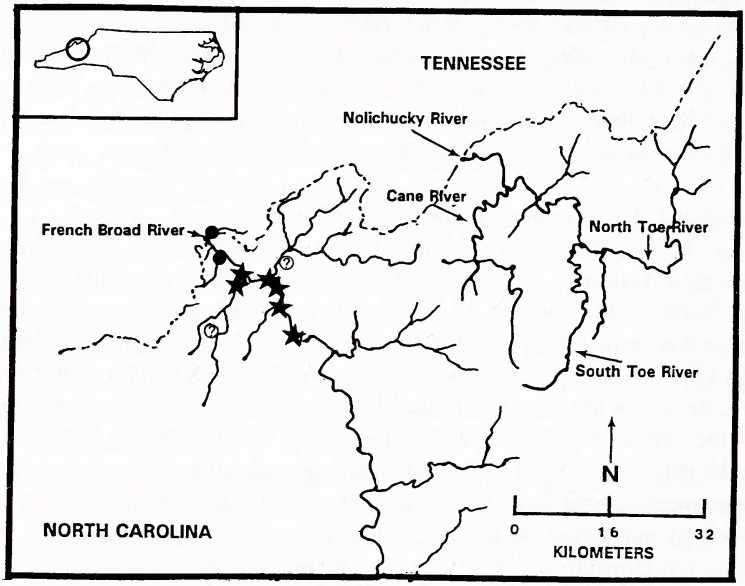
The striped shiner is common in the southern Great Lakes basin from western New York and southeastern Wisconsin south through much of the Mississippi River basin almost to the Gulf of Mexico (Page and Burr 1991). A disjunct population was discovered in the Cane River, Yancey County, North Carolina in 1980 by E. Menhinick, and soon thereafter it was known from five sites in the Cane River system (Menhinick 1986). We found it in four sites in 14.5 rkm of the middle reach of the Cane River and in two tributaries, Bald and Indian creeks (Fig. 6), in 1994. Numbers taken per our collections ranged from 2-23. Specimens ranged from 29-107 mm TL. Tennessee Valley Authority biologists took 61 individuals in one collection in the Cane River in 1992 (E. Scott, personal communication, 1994) (Fig. 6). Preferred habitat was pools and runs. Current ranged from 0.39-0.57 m/sec, pH 7.0-7.5, and dissolved oxygen concentration 6.8-8.4 ppm. Its status of threatened in North Carolina is warranted.

Banded sculpin, *Cottus carolinae* (Gill)

The banded sculpin inhabits mountainous areas of the Mississippi River basin from West Virginia west to Kansas and from the Ozark Mountains southeast to southern Alabama (Page and Burr 1991). In North Carolina it was reported only from Big Laurel and Spring creeks, Madison County (Robins 1954). Menhinick (1986) later reported it as restricted to the main stream of the French Broad River in North Carolina near the Tennessee line and absent from the two creeks. E. Menhinick (personal communication, 1994) took two adults and eight juveniles with rotenone in the downstream-most 100 m of Shut-in Creek, Madison County, North Carolina in July 1994 (Fig. 7). We did not collect it at two upstream-sites in this creek in 1994. However, we did take 58 specimens in two collections made on 14 May and 19 July 1994 throughout the lower 300 m of

Paint Creek, Greene County, Tennessee. This creek enters the French Broad River some 120 m downstream of the North Carolina/Tennessee line (Fig. 7). Its status as threatened appears to be conservative.

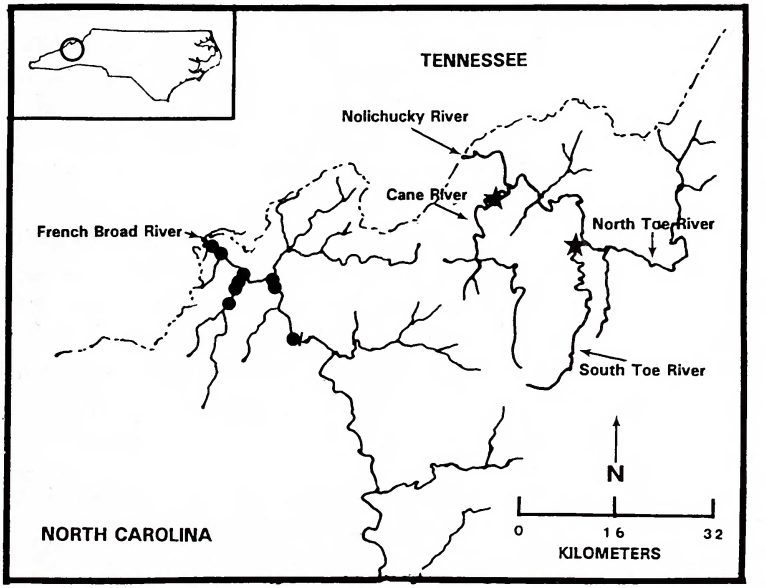
Fig. 7. Distribution of the banded sculpin, *Cottus carolinae*, (circle) and the freshwater drum, *Aplodinotus grunniens*, (star) in the French Broad River system, North Carolina. A circle with a question mark indicates an undefined historical site of the banded sculpin. Some symbols overlap sites.



Logperch, *Percina caprodes* (Rafinesque)

The logperch occurs from central Canada and the upper Mississippi River and adjacent drainages south to the Gulf of Mexico, and on Atlantic Slope drainages from the Hudson River south to portions of the Chesapeake Bay drainage (Rohde et al. 1994). In North Carolina it is known from four sites in the French Broad River between Redmon Dam and the Tennessee state line (Harned 1979) (Fig. 8), four specimens were collected below Redmon Dam in 1986 and 1987 (Birchfield et al. 1987) (Fig. 8), and from one site in the New River, Allegheny County (Menhinick 1986). We collected eight adults (88-132 mm SL) at four sites in the downstream reaches of the French Broad River and at two sites in the downstream portion of Spring Creek, Madison County on 13 May; 19, 22 July; and 5 November 1994 (Fig. 8). One specimen was taken in

Fig. 8. Distribution of the logperch, *Percina caprodes*, (circle) and the olive darter, *Percina squamata*, (star) in the French Broad and Nolichucky river systems, North Carolina. Some symbols overlap sites.



Spring Creek 7.1 rkm upstream from its mouth in July 1994 (S. Bryan, personal communication, 1994) (Fig. 8). Preferred habitat in the river was runs with large boulders. Current at our Spring Creek site was 0.58 m/sec, pH 7.1-7.6, and dissolved oxygen concentration 7.1-10.5 ppm. Its status of threatened is warranted.

Freshwater drum, *Aplodinotus grunniens* Rafinesque

The freshwater drum occurs throughout the Mississippi River basin from southern Canada and the Great Lakes to western Texas and western Florida (Rohde et al. 1994). Prior to this survey, it was known in North Carolina from six sites in the lower reaches of the French Broad River downstream of Redmon Dam, Madison County (Harned 1979) (Fig. 7). We collected one large specimen (305 mm TL) in a pool in Spring Creek, at a point 1 rkm upstream of its confluence with the French Broad River, on 22 July 1994, and E. Menhinick (personal communication, 1994) took one specimen in the same month in Spring Creek at this confluence (Fig. 7). Its status of threatened is warranted due to the lack of juveniles in collections.

SPECIES OF SPECIAL CONCERN

Lake sturgeon, *Acipenser fulvescens* Rafinesque

The lake sturgeon is usually found over shoals in lakes and large rivers in central Canada and Hudson Bay and St. Lawrence River drainages, and in much of the Mississippi River drainage south to northeastern Louisiana (Page and Burr 1991). Eight specimens, presumably of this species, were taken from the French Broad River near Hot Springs in Madison County, North Carolina in 1945 (Brimley 1946). An occasional lake sturgeon is still reported from Douglas Reservoir in Jefferson County, Tennessee, but these are unsubstantiated records (Etnier and Starnes 1994). We set 2 large-mesh gill nets of 25 and 50 m total length in the French Broad River downstream of Hot Springs in mid-May 1995 and in the river at the mouth of Big Laurel Creek in mid-August but failed to collect sturgeon. Swift current limited sampling location possibilities at the former site and reduced gear efficiency. Local North Carolina state fishery biologists have no reported sightings (J. Borawa, personal communication, 1994). Menhinick (1986) considers the lake sturgeon to have been extirpated from North Carolina, and we concur.

Mooneye, *Hiodon tergisus* Lesueur

The mooneye is found in central and southern Canada and in much of the Mississippi River basin from the Great Lakes south to the Gulf of Mexico (Page and Burr 1991). It historically occurred in the upper reaches of the French Broad River near Bowman's Bluff, Henderson County, North Carolina in 1902 (Smith 1907), but it is now known only from Redmon Dam to the Tennessee state line (Menhinick 1986) based on several mooneye obtained from fishermen in the French Broad River just above the confluence with Big Laurel Creek by Harned (1979). We did not take it in this river in our electroshocker or gill net collections. Its status of special concern in North Carolina appears to be conservative.

River carpsucker, *Carpiodes carpio* (Rafinesque)

The river carpsucker occurs throughout the Mississippi River basin from Montana to Pennsylvania and south to the Gulf of Mexico (Lee and Platania 1980). There is one North Carolina 1947 record from the French Broad River near Hot Springs in Madison County (Menhinick 1986). It was also captured in the same river in Tennessee 41 rkm downstream of the North Carolina state line in 1979 (Harned 1979), but we failed to collect it in this study. Its status of special concern appears to be conservative.

Mountain madtom, *Noturus eleutherus* Jordan

The mountain madtom occurs in disjunct populations from northwestern Pennsylvania south and west through the Ohio River basin to the Red and

Ouachita river drainages in Oklahoma and Arkansas (Page and Burr 1991). The only verified North Carolina specimens are from Spring Creek, Madison County and were collected in 1889 (Taylor 1969). It was also collected at two sites in the French Broad River just upstream of Douglas Reservoir, Cocke County, Tennessee (32 km downriver of North Carolina) during a 1979 TVA survey (Harned 1979). We did not collect it at any of the 34 sites we surveyed in the lower reaches of the French Broad River system. We concur with Menhinick (1986) that it has been extirpated from North Carolina.

Snubnose darter, *Etheostoma simoterum* (Cope)

The snubnose darter is abundant in the Tennessee River drainage from southwestern Virginia to northern Alabama (Rohde et al. 1994). The only putative extant specimen from North Carolina was reported by Cope (1870) and is now in the United States National Museum, but it is unclear from Cope's records whether its provenance is North Carolina or Tennessee (Menhinick 1986). Menhinick (1986) reported two unverified records from Laurel and Spring creeks, Madison County, North Carolina. We collected no snubnose darter, nor did Menhinick (1986). M. Hopey, who made 13 collections for a general survey of the streams in this area for the Western North Carolina Alliance in 1992, did not collect it (M. Kelly, personal communication, 1994). We consider the past or present occurrence of this darter in North Carolina to be highly doubtful.

Wounded darter, *Etheostoma vulneratum* (Cope)

The wounded darter is restricted to the upper Tennessee River drainage from Virginia to Georgia (Rohde et al. 1994). It is abundant in the Little Tennessee River in North Carolina (F. Rohde, personal observations). Although the type locality is Spring Creek, Madison County, North Carolina (Cope 1870), none has been reported from the French Broad River system in North Carolina since then, including our survey. Harned (1979) collected one specimen in the French Broad River in Tennessee at a point approximately 23 km downstream of the North Carolina state line. We conclude that it has been extirpated from the French Broad River system in North Carolina. Its status of special concern in North Carolina appears conservative.

Olive darter, *Percina squamata* (Gilbert and Swain)

The olive darter is confined to the Rockcastle and Big South Fork rivers in the Cumberland River drainage in Kentucky and Tennessee and to the upper Tennessee River drainage (Rohde et al. 1994). There are five records from the lower reaches of the French Broad River system (three in the main river and two in Spring Creek) in North Carolina, and four records from the Nolichucky River system (three in Cane River and two in North Toe River); it also occurs in the Little Tennessee and upper Hiwassee rivers in the state (Menhinick 1991). We

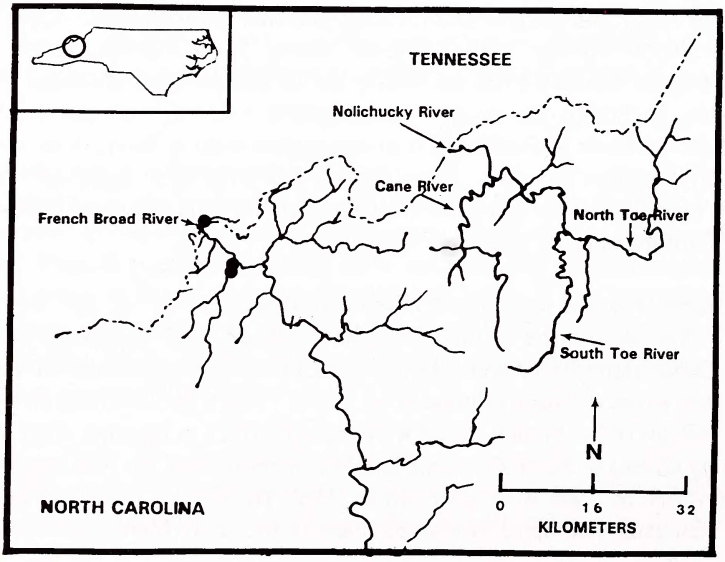
did not collect it in the French Broad River system, but we collected one juvenile (38 mm SL) in the Cane River on 19 July 1993, and three adults (104 mm SL, two released) in the South Toe River on 5 September 1993 (Fig. 8). Preferred habitat is around large boulders in fast riffles. Its status of special concern in North Carolina appears to be conservative.

NEW STATE RECORD

Ohio lamprey *Ichthyomyzon bdellium* (Jordan)

The Ohio lamprey occurs in disjunct populations in the Ohio River basin, where it is uncommon (Rohde and Lanteigne-Courchene 1980). Because of its presence in nearby Tennessee, Menhinick et al. (1974) listed its occurrence in North Carolina as probable. However, there were no records from North Carolina until we took one male and three females from the mouth of Spring Creek, Madison County, on 14 May 1994 (Fig. 9). Each was adult (220-260 mm TL), had a well-developed digestive tract, and each female was gravid. We took another three males (243-246 mm TL), one female (244 mm TL), and two juveniles (not ammocoetes, nor mature adults) (152, 153 mm TL) here on 22 April 1995, as well as two adult males (239, 248 mm TL) 1 rkm further upstream in this creek on the same day. We took three females (235-240 mm TL) in nearby Paint Creek, Greene County, Tennessee on 14 May 1995. All our specimens were taken over rocky riffles with a current from 0.45-0.78 m/sec.

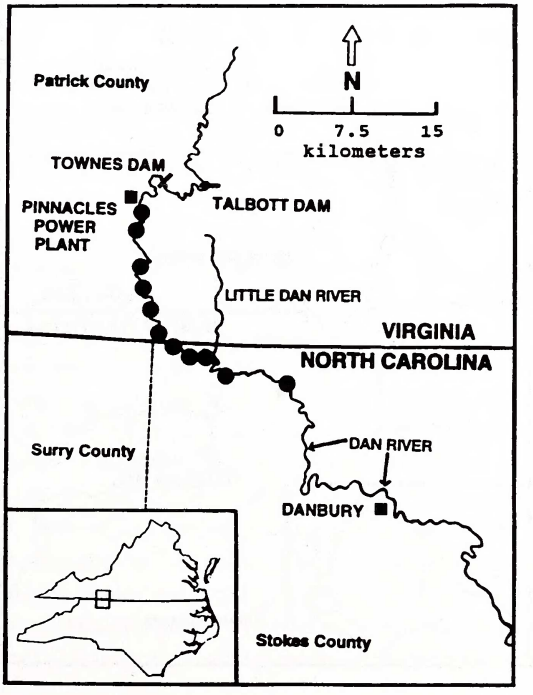
Fig. 9. Distribution of the Ohio lamprey, *Ichthyomyzon bdellium*, in the French Broad River system, North Carolina.



DAN RIVER SYSTEM
ENDANGERED
Cutlips minnow, *Exoglossum maxillingua* (Lesueur)

The cutlips minnow occurs on the Atlantic slope from the St. Lawrence River and eastern Lake Ontario drainages south to the upper Dan River in North Carolina (Gilbert and Lee 1980). Menhinick (1986) reported it from one site on the Dan River in Stokes County, North Carolina, within 1.6 rkm downstream of the Virginia state line. We found it in the North Carolina portion of this river at four sites from the Virginia line downstream to NC Route 704 and at six Virginia sites upstream to the Pinnacles Power Plant, over a total distance of 43 rkm (Fig. 10). Numbers (39) taken in our collections ranged from 1-6 (mean 3.9), and their length ranged from 69-133 mm SL; most specimens were adults. This species preferred fast-flowing runs or pools, near large rocks or boulders over sand and gravel. Current where it was collected was 0.54-0.75 m/sec; water temperature 7.7 C (November)-22 C (July); pH 6.8-7.6; and dissolved oxygen concentration 10.6-11.8 ppm (both November). The species appears to be secure in its limited distribution in North Carolina.

Fig. 10. Distribution of the cutlips minnow, *Exoglossum maxillingua*, in the Dan River system, North Carolina and Virginia.



Rustyside sucker, *Thoburnia hamiltoni* Raney and Lachner

The rustyside sucker is endemic to the upper Dan River system in North Carolina and Virginia (Jenkins and Burkhead 1994). In North Carolina it is known only from the 1.4 rkm downstream-most portion of the Little Dan River in Stokes County. Here Menhinick (1986) collected four specimens at a point some 400 m downriver of the Virginia line in 1985 (Fig. 11). We made three collections in the Little Dan River, from its confluence with the Dan River upstream to the North Carolina/Virginia line, and took one adult (144 mm SL) in a run with gravel and rubble substrate on 21 December 1992. In Virginia we took three adults (118-142 mm SL) in the Dan River at one site located 365 m, and at another site 914 m, downriver of the Pinnacles Power Plant on 28 November 1993 (Fig. 11). Both sites were deep and fast rock-strewn riffles, current velocity 0.62-0.75 m/sec, water temperature 8.3 C, pH 6.8, and dissolved oxygen concentration 10.0 ppm. The distribution of the rustyside sucker in North Carolina is extremely limited, and its continued existence there is precarious.

Fig. 11. Distribution of the rustyside sucker, *Thoburnia hamiltoni*, in the Dan River system, North Carolina and Virginia.

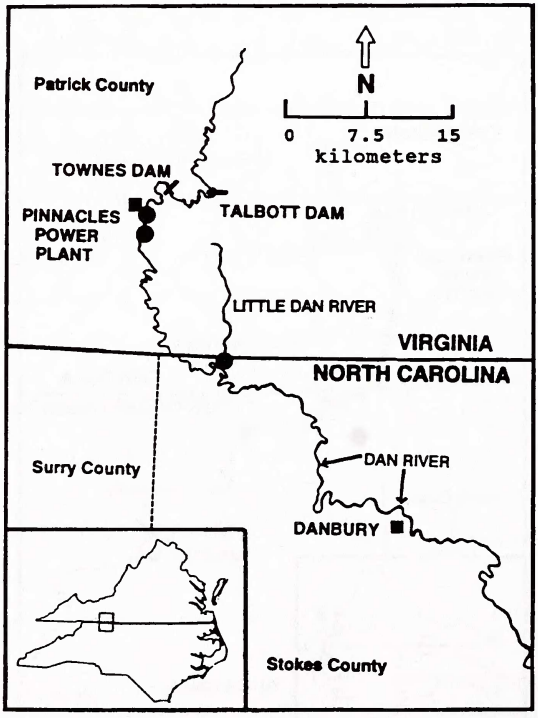
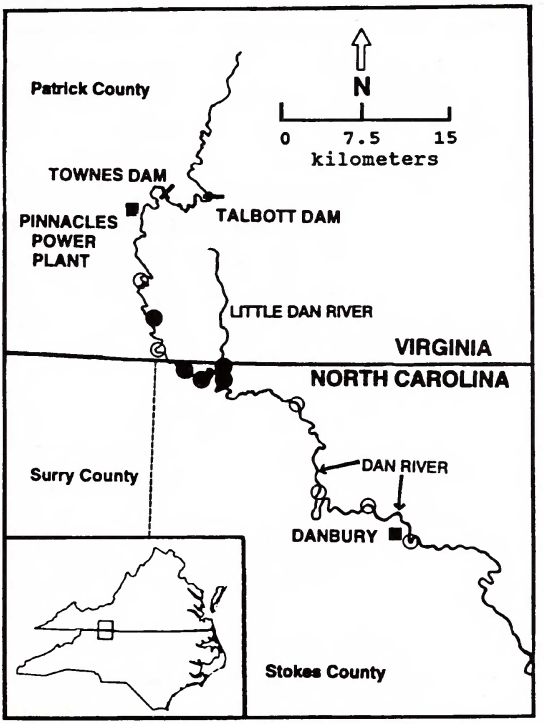


Fig. 12. Distribution of the orangefin madtom, *Noturus gilberti*, in the Dan River system. An open circle indicates an historical site where the species was not taken in this survey.



Orangefin madtom, *Noturus gilberti* Jordan and Evermann

The orangefin madtom is a Roanoke River drainage endemic (Jenkins and Burkhead 1994). Menhinick (1986) reported it from five North Carolina localities in the Dan River from the Virginia line downstream to Danbury, all discovered after 1968. Simonson and Neves (1986) found it at four Dan River sites in 45.2 rkm in North Carolina during a 1985 survey; including three of the Menhinick (1986) sites. We collected two adults (photographed and released) at 2 sites (of 16 sampled) in the Dan River in North Carolina 1.6 and 7.3 rkm below the Virginia line on 16 and 17 July 1992 (Fig. 12). Personnel from the North Carolina Wildlife Resources Commission took two individuals (93 and 96 mm TL) at an intermediate site on 5 October 1990 (A. Braswell, North Carolina State Museum of Natural Sciences, personal communication, 1992) (Fig. 12). We did not take it in three collections made at the downstream-most historical locality in the Dan River near Danbury in Stokes County, North Carolina, nor in five col-

lections made at three other historic localities upstream of this site in this river and state (Fig. 12). We took the first specimens known from the Little Dan River in North Carolina, at a point 1.1 rkm upstream of the confluence with the Dan River: one adult (released) on 21 December 1992, and one subadult (68 mm SL) on 21 August 1993 (Fig. 12). We also took three adults and one subadult (44-75 mm SL) at one locality in the Dan River in Virginia on 10 June 1994 (Fig. 12). Simonson and Neves (1986) took it at four Dan River sites in 12.4 rkm in Virginia. All fishes were taken in riffles with a gravel/rubble substrate; pH was 7.6-8.0.

Our capture of the two specimens in the Little Dan River was surprising, especially since Jenkins and Burkhead (1994) presumed that it had disappeared from this river. Since we did not take it at the four historical downstream-most sites in the Dan River in North Carolina (Fig. 12), we suspect that it may now be absent there. Its status of endangered in North Carolina is warranted.

SPECIAL CONCERN

Bigeye jumprock, *Scartomyzon ariommus* (Robins and Raney)

The bigeye jumprock is endemic to the upper and middle portions of the Roanoke River drainage in North Carolina and Virginia (Jenkins and Burkhead 1994). We found it at eight sites in a 41 rkm section of the Dan River, Stokes and Rockingham counties, North Carolina, between July 1992 and May 1995 and in the Mayo River, a tributary of the Dan River, 1.1 rkm below the Virginia state line on 22 August 1993 (Fig. 13). We collected 32 adults (106-170 mm SL, mean 154.1 mm) and 3 juveniles (52-91 mm SL, mean 75.3 mm); collections ranged from 1-7. Adults were taken in deep runs and heads of pools, usually near large boulders and rock outcrops, and juveniles in a shallow gravel riffle (one specimen) and in a sandy-bottomed pool (two); pH at capture sites was 7.4-7.8. Duke Power Company personnel (unpublished data) took two individuals by electroshocker at the Dan River Steam Station in Eden in Rockingham County, North Carolina, in August 1990 (Fig. 13). Within its limited distribution in North Carolina, this difficult-to-collect species is apparently secure.

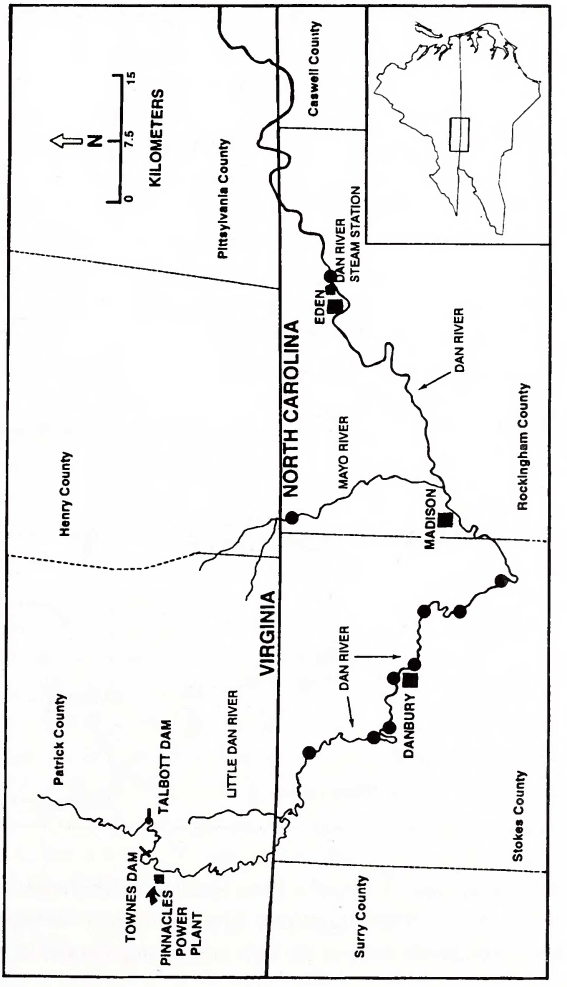
Riverweed darter, *Etheostoma podostemone* Jordan and Jenkins

The riverweed darter is endemic to the upper Roanoke River drainage in North Carolina and Virginia (Jenkins and Burkhead 1994). It is widely distributed in the Dan River and its tributaries (Menhinick 1991). We found it in a 124 rkm section of the main Dan River in North Carolina between July 1992 and May 1995, as well as in the Little Dan River, Mayo River, and Virginia portion of the upper Dan River (Fig. 14). We collected 434 specimens from 21-61 mm SL, ranging 2-62 (mean 21.7) per collection. It was common in shallow riffles with a gravel/cobble substrate; pH was 7.4-8.1. Within its limited distribution in North Carolina, the species is apparently secure.

SUMMARY AND CONCLUSIONS

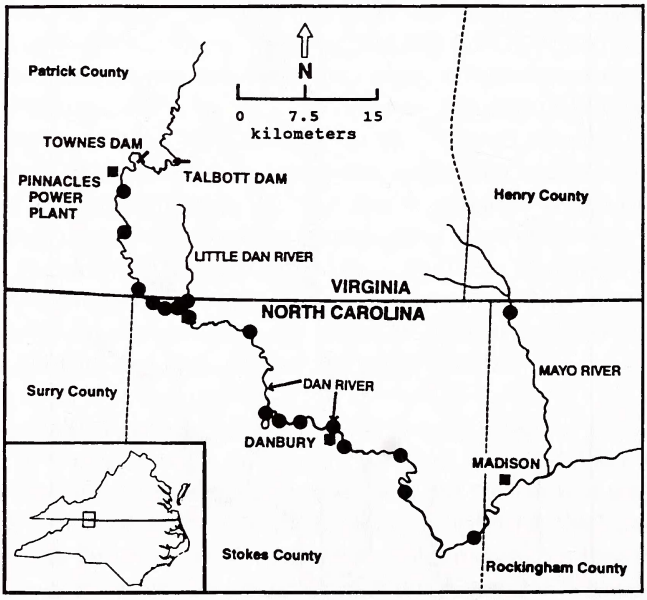
We conducted surveys for 22 North Carolina fishes currently considered to be endangered, threatened, and of special concern and known from the French Broad River (14 species), Nolichucky River (5 species), and Dan River system (5 species). We made 105 collections over the period July 1991-May 1995 inclusive, and augmented these collections with data from the literature and from personal communications.

Fig. 13. Distribution of the bigeye jumprock, *Scartomyzon ariommus*, in the Dan River system, North Carolina.



We did not collect two of the seven species considered to be endangered, the paddlefish and dusky darter, and believe that they have been extirpated from the state. The cutlips minnow in North Carolina is restricted to the Dan River, where we found it in 21 rkm rather than the 1.6 rkm in which it was previously known; this population at present appears to be secure. The rustyside sucker in North Carolina is confined to the downstream reaches of the Little Dan River, where it is extremely rare. We discovered that the North Carolina distribution of the stonecat is significantly larger than the small portion of the Cane River from which it was previously known, and to also include the Ivy River and the Little Tennessee River. Nevertheless, its status of endangered is warranted. The orangefin madtom in North Carolina is restricted to the Dan and to the Little Dan rivers; its distribution there appears to have decreased. The blotchside logperch in North Carolina has been extirpated from historical sites in the French Broad River system, and it is today restricted to 24 rkm of the South Toe River; its continued existence there appears to be tenuous.

Fig. 14. Distribution of the riverweed darter, *Etheostoma podostemone*, in the Dan River system, North Carolina and Virginia.



Records of all six North Carolina species considered threatened were collected in our survey. The American brook lamprey in North Carolina is known only from the downstream portion of Spring Creek; consequently, we

believe that its status in North Carolina should be increased to endangered. The spotfin chub has apparently been extirpated from at least Alabama and Georgia, as well as from the French Broad River system and the Tuckaseegee River in North Carolina, and it remains only in the Little Tennessee River; its status in North Carolina should probably be elevated to endangered. A viable population of the striped shiner is present in the Cane River. Its status of threatened in North Carolina is appropriate. Although we did not collect the banded sculpin, E. Menhinick took 10 specimens in North Carolina in a creek tributary to the lower French Broad River in 1994. Its status more accurately may be described as endangered. The logperch was found at several sites in the French Broad River and in Spring Creek. Its North Carolina status of threatened is warranted. Two freshwater drum were taken in Spring Creek. We doubt that a viable population of this species occurs in North Carolina, and it appears to be endangered.

Of the nine listed species of special concern that we surveyed, the bigeye jumprock and riverweed darter have apparently healthy populations in the limited Dan River system area in which they occur in North Carolina. The wounded darter in North Carolina apparently has been extirpated from the French Broad River system, although it is still abundant in the Little Tennessee River. Its status in North Carolina is more accurately described as threatened. The olive darter apparently still occurs in very low numbers in the French Broad River system, as well as in the Cane, North Toe, and South Toe, but its current status appears too conservative. We believe that the mountain madtom and the snubnose darter have been extirpated from North Carolina. We did not collect the lake sturgeon, mooneye, or the river carpsucker, nor could we obtain any recent records. The occasional specimens of these larger species, if they still occur, would be exceedingly difficult to catch. If they have not yet been extirpated from North Carolina, they almost certainly do not today have reproducing populations there.

We report the first North Carolina specimens of the Ohio lamprey, from Spring Creek, Madison County.

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